JC07 Rec'd PCT/PTO 30 APR 2001

FORM-PTO-1390 (Rev. 12-29-99) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: 027650-928

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5): Unassigned 09/830686

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/JP99/05966	28 October 1999	30 October 1998

TITLE OF INVENTION: HEAT-SEALING DEVICE

APPLICANT(S) FOR DO/EO/US: Keiji YANO

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and the PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☒ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☐ Other items or information:

JC08 Rec'd PCT/PTO 30 APR 2001

U.S. APPLICATION NO (If known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
Unassigned 09/830686	PCT/JP99/05966	027650-928

17. ☒ The following fees are submitted:	CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492(a)(1)-(5)):		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO $1,000.00 (960)		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO $860.00 (970)		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO $710.00 (958)		
International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) $690.00 (956)		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) $100.00 (962)		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 860.00	
Surcharge of **$130.00 (154)** for furnishing the oath or declaration later than 20 ☐ 30 ☐ months from the earliest claimed priority date (37 CFR 1.492(e)).	$ 0.00	

Claims	Number Filed	Number Extra	Rate		
Total Claims	20 -20 =	0	X$18.00 (966)	$ 0.00	
Independent Claims	3 -3 =	0	X$80.00 (964)	$ 0.00	
Multiple dependent claim(s) (if applicable)			+$270.00 (968)	$ 0.00	
			TOTAL OF ABOVE CALCULATIONS =	$ 860.00	
Reduction for 1/2 for filing by small entity, if applicable (see below).				$ 0.00	-
			SUBTOTAL =	$ 860.00	
Processing fee of **$130.00 (156)** for furnishing the English translation later than 20 ☐ 30 ☐ months from the earliest claimed priority date (37 CFR 1.492(f)). +				$ 0.00	
			TOTAL NATIONAL FEE =	$ 860.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00 (581)** per property +				$ 0.00	
			TOTAL FEES ENCLOSED =	$ 860.00	
			Amount to be: refunded	$	
			charged	$	

a. ☐ Small entity status is hereby claimed.

b. ☒ A check in the amount of $ 860.00 to cover the above fees is enclosed.

c. ☐ Please charge my Deposit Account No. 02-4800 in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

d. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 02-4800. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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32,814
REGISTRATION NUMBER

09/830686

JC08 Rec'd PCT/PTO 30 APR 2001

Patent
Attorney's Docket No. 027650-928

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	)	
Keiji YANO	)	Group Art Unit: Unassigned
Application No.: Corresponds to International Application No. PCT/JP99/05966	)	Examiner: Unassigned
International Application Filed: October 28, 1999	)	
For: HEAT-SEALING DEVICE	)	

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Preliminary to examination of the above-captioned patent application, kindly amend the application in the following manner.

IN THE SPECIFICATION:

Kindly delete pages 1-10 of the specification and substitute therefor the attached substitute pages 1-15.

IN THE ABSTRACT:

Kindly delete the original Abstract in its entirety and substitute therefor the new Abstract of the Disclosure which accompanies this Preliminary Amendment as a separate sheet.

IN THE CLAIMS:

Kindly cancel Claims 1-8 without prejudice or disclaimer of the subject matter contained therein.

Kindly add the following new Claims 9-28.

-- 9. (New) A heat-sealing device which moves a tube-shaped packaging material, formed from a packaging material web and filled up with liquid food under a liquid surface of the liquid food, through operation of a seal jaw and a counter jaw, and transversely heat-seals the tube in a seal zone of the tube-shaped packaging material that contains a cutting predetermined zone through softening or melting of plastic material forming the packaging material, the seal jaw and the counter jaw both including an operation surface that is adapted to face the seal zone, the operation surface of the seal jaw being a flat surface, and including removal/mixture means on the operation surface of the counter jaw for removing from the seal zone seal prevention impurity which may remain in the seal zone, and/or mixing the seal prevention impurity with the plastic material that has softened or melted.

10. (New) The heat-sealing device of Claim 9, wherein the removal/mixture means is a sloped surface forming the operation surface of the counter jaw.

11. (New) The heat-sealing device of Claim 10, wherein the sloped surface is a chevron-shaped surface.

12. (New) The heat-sealing device of Claim 9, wherein the removal/mixture means is a ridge continuously or discontinuously formed at the operation surface of the counter jaw.

13. (New) The heat-sealing device of Claim 9, including an inductor for high frequency induction heating that is arranged at the seal jaw, and the packaging material comprises a metal thin layer and a thermoplastic material innermost layer.

14. (New) The heat-sealing device of Claim 9, including a horn for forming the seal zone by ultrasonic heating that is arranged at the seal jaw, and the packaging material includes at least a thermoplastic material innermost layer.

15. (New) The heat-sealing device of Claim 9, including a resistance body for forming the seal zone by heating that is arranged at the seal jaw, and the packaging material includes at least a thermoplastic material innermost layer.

16. (New) A heat-sealing device which transversely seals a tube-shaped packaging material filled up with liquid food under a liquid surface of the liquid food to form a seal zone of the tube-shaped packaging material through softening or melting of plastic material forming a part of the tube-shaped packaging material, comprising a seal jaw and a counter jaw positioned in opposition to one another, the seal jaw including means for effecting softening or melting of the plastic material forming a part of the tube-shaped

packaging material, the seal jaw and the counter jaw both including an operation surface that is adapted to face the seal zone during transverse sealing, the operation surface of the seal jaw being a flat surface, the operation surface of the counter jaw being formed with one of: at least one raised ridge; at least one chevron-shaped element; or a sloping surface, to remove seal prevention impurity which may remain in the seal zone, and/or to mix the seal prevention impurity with the softened or melted plastic material.

17. (New) The heat-sealing device of Claim 16, wherein the operation surface of the counter jaw is formed as a sloped surface.

18. (New) The heat-sealing device of Claim 16, wherein the operation surface of the counter jaw is formed with a ridge.

19. (New) The heat-sealing device of Claim 16, wherein the means for effecting softening or melting of the plastic material forming a part of the tube-shaped packaging material includes an inductor for high frequency induction heating.

20. (New) The heat-sealing device of Claim 16, wherein the means for effecting softening or melting of the plastic material forming a part of the tube-shaped packaging material includes a horn for forming the seal zone by ultrasonic heating.

21. (New) The heat-sealing device of Claim 16, wherein the means for effecting softening or melting of the plastic material forming a part of the tube-shaped packaging material includes a resistance body for forming the seal zone by heating.

22. (New) A filling machine for advancing a packaging material web, forming the web into a tube-shaped packaging material, filling up liquid food in the tub-shaped packaging material, and transversely heat-sealing the tube-shaped packaging material in a seal zone of the packaging material containing a cutting predetermined zone through softening or melting of plastic material forming the packaging material, comprising a heat-sealing device for forming the seal zone, the heat-sealing device comprising a seal jaw and a counter jaw that both include an operation surface adapted to face the seal zone, the operation surface of the seal jaw being a flat surface, and including removal/mixture means on the operation surface of the counter jaw for removing from the seal zone seal prevention impurity which may remain in the seal zone, and/or mixing the seal prevention impurity with the plastic material that has softened or melted.

23. (New) The heat-sealing device of Claim 22, wherein the removal/mixture means is a sloped surface forming the operation surface of the counter jaw.

24. (New) The heat-sealing device of Claim 23, wherein the sloped surface is a chevron-shaped surface forming the operation surface of the counter jaw.

25. (New) The heat-sealing device of Claim 22, wherein the removal/mixture means is a ridge continuously or discontinuously formed at the operation surface of the counter jaw.

26. (New) The heat-sealing device of Claim 22, including an inductor for high frequency induction heating that is arranged at the seal jaw, and the packaging material comprises a metal thin layer and a thermoplastic material innermost layer.

27. (New) The heat-sealing device of Claim 22, wherein a horn for forming the seal zone by ultrasonic heating that is arranged at the seal jaw, and the packaging material includes at least a thermoplastic material innermost layer.

28. (New) The heat-sealing device of Claim 22, including a resistance body for forming the seal zone by heating that is arranged at the seal jaw, and the packaging material includes at least a thermoplastic material innermost layer. --

REMARKS

To improve the form and wording of the written description, a substitute specification is submitted with this Preliminary Amendment. No new matter has been introduced. To assist the Examiner, attached is a marked-up version of the substitute specification indicating the changes relative to the original specification. Additions in the substitute specification are shown with bold and underlining while deletions are bracketed and lined through. Also, to ensure compliance with the relevant guidelines, a new Abstract of the Disclosure is also submitted with this Preliminary Amendment.

Finally, to present claims that more closely correspond to U.S. patent practice, original Claims 1-8 have been canceled and new Claims 9-28 are presented for consideration.

Early and favorable consideration of this application is respectfully requested.

Should any questions arise in connection with this application, the undersigned respectfully requests that he be contacted at the number indicated below.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

By: _____

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Date: April 30, 2001

ABSTRACT OF THE DISCLOSURE

A heat-sealing device moves a tube-shaped packaging material through operation of a seal jaw and counter jaw under the liquid surface of liquid food, and heat-seals a seal zone containing a cutting predetermined zone in the tube transverse direction. The tube-shaped packaging material is formed from the packaging material web, and is filled up with liquid food. The operation surface of the seal jaw facing the seal zone has a substantially flat surface. The heat-sealing device has a removal/mixture mechanism on the operation surface of the counter jaw. The removal/mixture mechanism removes seal prevention impurity from this seal zone and/or mixes the impurity with the melting/softening packaging material in this seal zone. Thus, even if the packaging laminated material is covered with an oxide, residual substances, or impurities, the heat-sealing device reduces the bad influence of the seal prevention impurity.

[Specification] FIELD OF THE INVENTION

[Heat-sealing device

Technical field]

[0001] This invention relates to [the] **a** device which heat-[heals the] **seals** tube [shape] **shaped** packaging material fabricated from [the] **a** packaging material web in the [transversal direction, and the filling machine which manufactures the packaging container filled up with fluid food, and has] **transverse direction, and a filling machine utilizing** this heat-sealing device **to manufacture a packaging container filled with fluid food.**

BACKGROUND OF THE INVENTION

[0002] [Background art] A filled packaging container [is] used for milk, [a] fruits drink, etc.[, and,] **is** generally [is] made from laminated packaging [material.Packaging] **material. The packaging** material has [the] **a** comparatively rigid main supporting layer covered with [the] thin layers of plastic [materials.This] **materials. This** material can also contain [the material of] **materials such as** aluminum foil [or others.The]. **The** common feature of this type of [all] packaging laminated material is that the thermoplastic material (usually polyethylene) layer provided [an] **on the** outside and inside [laminated material seals two portions] of the laminated material [which countered to each other in the] **is used to form a seal in a** liquid tight state with heat and [pressure.In] **pressure. In** order for a seal to

have **a** desired strength and a desired liquid tight performance, both ~~[two]~~ thermoplastic layers ~~[to seal are surely]~~ **that are to be sealed should be** clean, and ~~[it is required]~~ **should** not ~~[to]~~ include ~~[impurities.In such case of the]~~ **impurities. With a** clean layer, sufficient melting of each thermoplastic layer can be obtained and, as a result, the optimum seal ~~[is brought]~~ **can be achieved** by strong high sealing ~~[performance.Since the]~~ **performance. Since** impurities of the thin oxide formed on **the** packaging laminated material during **the** extrusion steps of thermoplastic layers usually exist in ~~[a]~~ **the** thermoplastic layer, ~~[the]~~ **a** perfect melting between **the** thermoplastic layers is ~~[alike]~~ occasionally~~[, and is blockedTherefore]~~ **prevented. Therefore**, a seal cannot acquire ~~[possible]~~ **the necessary** strength and ~~[possible]~~ sealing ~~[performance.Moreover]~~ **performance. Moreover**, when sealing packaging materials under ~~[the surface of]~~ liquid food, ~~[the impurity of the]~~ **impurities associated with** residual ~~[substance]~~ **substances** of the ~~[content]~~ **contents** (liquid food) which hinders the sealing further may also be generated **or present** on the surface of ~~[a]~~ **the** thermoplastic ~~[layer.This]~~ **layer. This** is a problem peculiar to the packaging filling system ~~[that]~~ **in which sealing of** the ~~[seal of]~~ laminated material is performed under the liquid surface of **the** liquid ~~[foods.That]~~ **food. That** is, in this packaging filling **system**, the content food must be first pushed out from the crevice between the surfaces of **the** thermoplastic materials before sealing.

[0003] However, as a practical ~~[question, the residual substance of]~~ **matter, a** very small quantity **of residual substance** remains, without ~~[squeezing out]~~ **the**

content food **being** completely **squeezed out**, and this residual substance weakens the seal.

~~[Disclosure of the invention]~~

SUMMARY OF THE INVENTION

[0004] The ~~[purpose of this]~~ invention ~~[is offering the]~~ **involves a** device which can heat-~~[heal]~~ **seal** the above-mentioned packaging laminated material so that all the above-mentioned problems may be avoided, ~~[having the]~~ **and thereby provide** optimum seal ~~[performance. The further purpose of this]~~ **performance. The** invention ~~[is offering the]~~ **also provides a** device which heat-~~[heals]~~ **seals** the packaging laminated material ~~[which can lose]~~ **to avoid** the bad influence of ~~[such a]~~ seal prevention ~~[impurity]~~ **impurities** as much as possible, ~~[and makes the]~~ **while making an** optimum seal possible, even if **the** packaging laminated material is covered with an oxide, the residual substance of ~~[a]~~ **the** packaging content, or impurities.

~~[~~

~~The above-mentioned subject is solved by the heat-sealing device according to this invention.]~~

[0005] The heat-sealing device heat-~~[heals]~~ **seals** a tube ~~[shape]~~ **shaped** packaging material in the ~~[transversal]~~ **transverse** direction under the surface of **the** liquid food. ~~[Tube shape]~~ **The tube-shaped** packaging material is packaging material ~~[with which it is]~~ formed ~~[by]~~ **into** the tube shape from a packaging

material web, [~~and~~] **with the** liquid food [~~is~~] **being** filled up in this [~~tube.The~~] **tube. The heat-sealing** device pushes this tube from its outside by the seal jaw and the counter jaw, and heat-[~~heal~~] **seals** the tube in the [~~transversal~~] **transverse** direction of the tube. The device heat-[~~heals~~] **seals** the seal zone of the packaging material containing a cutting predetermined zone under the surface of **the** liquid [~~food.The~~] **food. The** operation surface of the seal jaw in contact with the seal zone has a substantially flat [~~surface.The~~] **surface. The** operation surface of the counter jaw [~~is characterized by having~~] **includes a** removal/mixture means. The removal/mixture means removes **from** the **seal zone** seal prevention impurity which may remain in the tube [~~of a seal zone from this seal zone~~], and/or mixes the impurity with the melted or softened packaging material in the seal zone.

[~~In the preferable embodiment~~]

[0006] **In a preferred form** of this invention, **the** removal/mixture means may be [~~the~~] **a** slope provided in the operation surface of the counter [~~jaw.In the preferable embodiment~~] **jaw. The slope may be in the form** of [~~this invention, removal/mixture means may be the slope of~~] a [~~cross-sectional~~] chevron-[~~shape provided in the~~] **shaped** operation surface of the counter [~~jaw.In a preferable embodiment~~] **jaw. In another preferred form** of this invention, **the** removal/mixture means can be ridges continuously or discontinuously provided in the operation surface of the counter [~~jaw.In the preferable embodiment of this invention, the~~] **jaw. An** inductor for forming a seal zone by [~~the~~] high frequency

induction heating may be arranged in the seal jaw, and the packaging material may comprise a metal thin layer and a thermoplastic material innermost layer.

~~[In the preferable]~~

[0007] **In another preferred** embodiment of this invention, ~~[the]~~ **a** horn for forming a seal zone by ultrasonic heating may be arranged in the seal jaw, and the packaging material may comprise at least a thermoplastic material innermost ~~[layer.In the preferable embodiment]~~ **layer. In another version** of this invention, **an** electrical-resistor for forming a seal zone by heating is provided in the seal jaw, and **the** packaging material may have at least a thermoplastic material innermost ~~[layer.The]~~ **layer.**

[0008] **The** filling machine ~~[by]~~ **of** this invention forms a packaging material web ~~[to]~~ **into** a tube shape, fills up ~~[with]~~ liquid food in the tube, **and** heat-~~[heals]~~ **seals** and cuts the tube shape packaging material in the ~~[transversal]~~ **transverse** direction. The filling machine ~~[by]~~ **of** this invention ~~[is characterized by having]~~ **utilizes** the heat-sealing device ~~[by this above-mentioned invention.]~~ **mentioned above.**

~~[Brief description of the accompanying drawings]~~

BRIEF DESCRIPTION OF THE DRAWING FIGURES

~~[Fig. 1 is a]~~

[0009] **Fig. 1 is a cross-**sectional view showing the structure and operation of the heat-sealing device ~~[of the 1st]~~ **according to a first** example ~~[by]~~ **of** this ~~[invention.Fig]~~ **invention;**

[0010] **Fig**. 2 is a sectional view of the packaging material used for the heat-sealing device of this ~~[invention.Fig]~~ **invention;**

[0011] **Fig**. 3 is an outline figure showing the structure and operation of the filling machine equipped with the heat-sealing device ~~[by]~~ **of** this ~~[invention.Fig]~~ **invention;**

[0012] **Fig**. 4 is a **cross-**sectional view showing the structure and operation of the heat-sealing device ~~[of the 2nd]~~ **according to a second** example ~~[by]~~ **of** this ~~[invention.Fig]~~ **invention;**

[0013] **Fig**. 5 is a **cross-**sectional view showing the structure and operation of the heat-sealing device ~~[of the 3rd]~~ **according to a third** example ~~[by]~~ **of** this ~~[invention.Fig]~~ **invention;**

[0014] **Fig**. 6 is a **cross-**sectional view showing the structure and operation of the heat-sealing device ~~[of the 4th]~~ **according to a fourth** example ~~[by]~~ **of** this ~~[invention.Fig]~~ **invention;**

[0015] **Fig**. 7 is a **cross-**sectional view showing the structure of the counter jaw of the heat-sealing device ~~[of the 5th example by this invention.Fig. 8 is a]~~ **according to a fifth example of this invention; and**

[0016] **Fig. 8 is a cross-**sectional view showing the structure of the counter jaw of the heat-sealing device ~~[of the 6th]~~ **according to a sixth** example ~~[by]~~ **of** this invention.

~~[Detailed description of the invention]~~

DETAILED DESCRIPTION OF THE INVENTION

[0017] Hereafter, although the examples about the heat-sealing device according to this invention are described based on the drawings, this invention is not limited to the examples indicated by these ~~[drawings.The]~~ **drawings. The** outline of an example of the filling machine equipped with the heat-sealing device ~~[by]~~ **of** this invention is shown in Fig. ~~[3.The]~~ **3. The** filling machine shown in this example is operated as ~~[follows.From]~~ **follows. From** a roll, a filling machine unwinds the packaging material web 1**,** which comprises a thermoplastic material layer ~~[in]~~ **as** an innermost layer, and conveys the **web to the** inside of the filling machine with ~~[rollers.The]~~ **rollers. The** filling machine seals the strip tape 2 to the end of the packaging material web ~~[by the]~~ **through operation of a** strip tape applicator 3, and sterilizes the packaging material web ~~[which passes]~~ **by passing it** through the inside of the sterilization agent bath ~~[4.The]~~ **4. The** filling machine removes the sterilization agent with an air-knife 5, and forms ~~[it to a tube]~~ **the web into a tubular** shape with forming rollers ~~[6.It fills]~~ **6. The tube is filled** up with liquid food from a filling pipe 7 ~~[in]~~ **extending into** the tube, and ~~[seals]~~ **is sealed by** a longitudinal seal element 8 in the **longitudinal** direction of ~~[longitudinal in]~~ the tube. ~~[Sending this]~~ **To advance the** tube below by ~~[the]~~ **a** length equivalent to one packaging container, the tube is pushed by seal jaws 10 and counter jaws 11 ~~[of]~~ **forming the** heat-sealing device of this invention, and the filling machine heat-~~[heals]~~ **seals** the tube in the ~~[transversal]~~ **transverse** direction, and ~~[forms it]~~ continuously ~~[in the]~~ **forms** pillow-shaped packaging ~~[container 12~~

~~simultaneously.Then,~~] **containers 12 simultaneously. Then,** a [~~cutting~~] predetermined zone of the seal zone of the pillow-shaped packaging container is cut[~~, and the filling machine separates~~] with a knife [~~in~~] **to separate** each packaging container 13, and **the** flaps of the upper and lower sides of the separated container [~~14~~] are folded[~~, and forms~~] **to form** the packaging container 11 having [~~a~~] **the** final shape with a final holder [~~14.An~~] **14.**

[0018] **An** example of the packaging material 1 which can be used in this invention is shown in Fig. [~~2.This~~] **2. This** packaging material has the [~~shown~~] **illustrated** layer structure, and consists of a thermoplastic material layer 31 [~~of~~] **forming** an outermost layer, a paper layer 32, a metal layer 33 [~~that is~~] **forming** an oxygen barrier layer, and a thermoplastic material layer 34 [~~of~~] **forming** an innermost layer.

[0019] The packaging material **used** in this invention is not limited to the above-mentioned example, but various packaging material can be used [~~for it~~]. For example, [~~a~~] packaging [~~laminate contains~~] **laminates can be used that contain** low-density polyethylene [~~(LDPE)~~]**(LDPE)**/ printing ink [~~layer / paper~~] **layer/paper** (fibrous) substrate [~~layer / LDPE / aluminum foil / LDPE/LDPE, LDPE / printing ink layer / paper substrate layer / LDPE/LDPE, printing ink layer / LDPE / paper substrate layer / LDPE/LDPE and LDPE / a printing ink layer / paper substrate layer / LDPE / aluminum / polyester (PET).~~]**layer/LDPE/aluminum foil/LDPE/LDPE, LDPE/printing ink layer/paper substrate layer/LDPE/LDPE, printing ink**

layer/LDPE/paper substrate layer/LDPE/LDPE, and LDPE/a printing ink layer/paper substrate layer/LDPE/aluminum/polyester (PET).

[0020] Moreover, the ethylene alpha olefin copolymer (the so-called metallocene PE) which polymerized using the single site catalyst can also be used ~~[for an]~~ **as the** innermost layer or/~~[,]~~ and ~~[the]~~ outermost layer in addition to **the** LDPE ~~[of the]~~ **mentioned** above.

[0021] Furthermore, the vapor deposited layer of an inorganic oxide can also be used as a practical substitute ~~[which substitutes]~~ for the metal layer (aluminum foil) ~~[of]~~ **as** the above-mentioned oxygen barrier layer.

[0022] Fig. 1 shows the seal device ~~[by]~~ **of** this invention in **cross-**section with the heat-healed packaging material 1. ~~[]~~The main part of the seal jaw 10 is made from ~~[an un]~~ **a non**-conductive material, and contains the cylindrical inductor 101 of a conductive material, for example, copper.

[0023] The inductor 101 **is** located in the center of the ~~[operation surface of a]~~ main part ~~[forms]~~ **forming** the operation surface 102 of the seal jaw 10 ~~[with the circumference portion of the main part]~~. The formed operation surface is a substantially flat surface. This inductor 101 is arranged ~~[in order]~~ to form the seal zone ~~[in the seal jaw 10]~~ by ~~[the]~~ high frequency induction ~~[heating. The]~~ **heating. The** packaging material in this case is a laminate which comprises the **thin** metal ~~[thin]~~ layer and the thermoplastic material innermost ~~[layer. In]~~ **layer. In** this high frequency induction heating, a magnetic field occurs around the coil which ~~[connects with]~~ **is connected to** a high frequency power supply ~~[and passes high frequency~~

~~current, an~~]. **An** eddy current arises in the metal foil of the coil circumference, and ~~[the]~~ Joule heat is generated by this eddy current and the resistance of **the** metal foil ~~[(layer).The]~~ **layer. The** generated Joule heat is transmitted to the thermoplastic material innermost layer which ~~[faced]~~ **faces** the metal ~~[(foil)]~~ **foil** layer, and melts this thermoplastic material ~~[layer.In]~~ **layer. In** this example, an inductor 101 corresponds to a part of coil of the above-mentioned high frequency induction heating. Other portions (not shown) of the coil can be arranged at the reverse side of an inductor 101 or to the exterior of the seal jaw 10 ~~[etc.In]~~**, etc. In** this invention, the operation surface 102 of the seal jaw 10 facing the seal zone 20 comprises a substantially flat surface. The operation surface 111 of the counter jaw 11 ~~[has the]~~ **possess a** removal/mixture means.

[0024] The removal/mixture means removes ~~[the]~~ seal prevention impurity from the seal zone 20, and ~~[mix]~~ **mixes** the impurity with the ~~[melting or softening (melting/softening)]~~ **melted or softened (melted/softened)** packaging material in the seal zone ~~[20.In]~~ **20. In** the case of this example, removal/mixture means is the ridge 111 continuously or discontinuously provided in the operation surface 112 of this counter jaw. The ridge 111 which projects from the operation surface 112 is provided in the counter jaw 11. The cross-sectional shape of this ridge 111 ~~[has a]~~ **is** mostly ~~[rectangle.]~~ **rectangular.** The height **of the ridge** is 0.2 to 0.8 times the thickness of laminated material, preferably 0.5 ~~[times.The]~~ **times. The** width is almost equal to the width of packaging laminated ~~[material.The]~~ **material. The** ridge is not limited to this example, for example~~[,]~~ it ~~[includes]~~ **can include** a ridge

with a round top, a ridge ~~[of a cross-sectional trapezoid, etc.The]~~ **having a trapezoidal cross-section, etc.**

[0025] **The** operation surface 102 of the seal jaw 10 contains the central zone which heats the laminated material 1. The counter jaw 11 ~~[has a]~~ **includes the** ridge ~~[111and]~~ **111 and** the adjoining zones of the ~~[ridge.In order to]~~ **ridge. To** enable high frequency welding of the laminated material 1 containing aluminum foil, the high frequency power supply is connected with an inductor 101, which heats **the** laminated ~~[material.When]~~ **material. When** sealing ~~[the]~~ **together** packaging laminated material which does not contain aluminum foil (metal layer 33) or other conductive layers ~~[together]~~, the laminated material heating zone may consist of, for example, resistance ~~[material.The]~~ **material. The** seal device ~~[by]~~ **of** this invention may modify this by various methods within the limits of the concept of this invention, in order to fulfill the necessary condition of ~~[the seal of the]~~ **sealing** different packaging containers and materials ~~[and.In]~~**. In** this example, the tube of packaging material is sealed in the ~~[transversal]~~ **transverse** direction to form a seal zone, and the seal zone is cut by ~~[a]~~ cutting **a** predetermined zone 21 in the seal zone. A knife (or a certain other suitable cutting devices) operates in the ~~[cutting]~~ predetermined zone ~~[21.Moreover]~~ **21. Moreover**, in this example, the eddy current by the oscillating magnetic field is induced in the aluminum (metal) layer 33 of the packaging laminated material ~~[1.The]~~ **1. The** aluminum (metal) layer 33 is heated ~~[at the]~~ **ro a** temperature higher than the melting point of the **adjoining** thermoplastic layer ~~[which adjoins]~~ in the zone corresponding to the surface of ~~[an]~~

the inductor [~~101.The~~] **101. The** generated heat is directly transmitted to the thermoplastic [~~layer~~] **layers** 34 and 34 located between the aluminum layers 33 and 33, **and** melts [~~a~~] **the** thermoplastic layer[~~, and~~] **which** is changed to a [~~fluid.For~~] **fluid. By virtue of** the high pressure (approximately 100kg/cm^2) at which [~~a~~] **the** ridge 111 pushes **the** packaging laminated material, the melted thermoplastic material runs and flows to the zones 20 and 20 from the high-pressure zone [~~21of~~] **21 of** the seal [~~zone.The~~] **zone. The** thermoplastic layers 34 and 34 which **are** counter to each other and [~~are~~] located in the zone outside the seal zones 20 and 20 [~~keep~~] **maintain a** solid state, and [~~they~~] are pushed, countering to each other. Without flowing out outside further, the melted thermoplastic material stops in the zone shown by [~~the~~] reference number 20 in the seal zone, and forms the high-pressure zone 21 and the accumulation zones 20 and 20. [~~Two layers mix and seal~~] **The two layers are mixed and sealed to each other** in an accumulation portion (zones 20 and 20) [~~to each other.~~]**.**

[0026] The excess of the plastic **that is** well mixed at the accumulation portions (zones) 20 and 20 formed in the seal zone is included, and [~~the~~] **a** seal of practically sufficient strength is obtained between **the** two layers.

[0027] Since the flow by the high pressure is very quick, the mixture [~~with a~~] **of** sufficient plastic material from between **the** two layers [~~which counter~~] is guaranteed by the turbulent flow generated [~~into~~] **in** the flowing plastic material.

[0028] Therefore, [~~the~~] residual [~~substance~~] **substances** of the oxide and the liquid food content [~~which exists~~] **existing** in the surface is effectively mixed within [~~a~~] **the**

plastic, and [~~the~~] **a** film of [~~the~~] impurities which [~~spoil~~] **might adversely affect** the strength of the seal does not remain.

[0029] The seal device [~~by~~] **of** this invention can be modified by various methods within the limits of the concept of this invention in order to fulfill the necessary condition of the seals of packaging containers.

[0030] Although the material [~~of~~] **forming** the ridge [~~which is hard to deform by the pressure during the seal step~~] in the above-mentioned example [~~was used, a ridge may be~~]**is hard in order to resist deformation associated with the pressure during the sealing step, the ridge may be made of** a deformable elastic material. In this case, although the [~~above~~] **same** seal zones 20 (accumulation portion) **as above** cannot be significantly formed between laminated packaging materials, a higher pressure can be made from a ridge [~~portion.The~~] **portion. The** seal prevention impurity which may remain in the seal zone is removed from [~~a~~] **the** seal zone, and in the seal zone, melted or softened packaging material can be [~~mixed.Fig. 4 illustrating the 2nd example shows~~] **mixed.**

[0031] **Fig. 4 illustrates a second example showing** the seal steps at the time of sealing two packaging laminated materials 1 and 1 [~~by~~] **through use** the [~~example of~~] device [~~by~~] **of** this invention. [~~]~~Two packaging laminated materials 1 and 1 (or two facing portions of the same folded-up packaging laminated material) are sealed [~~between~~]**, particularly** the thermoplastic layers of those innermost layers. The counter jaw 11 and the seal jaw 10 push **together the** packaging laminated [~~materials.This~~] **materials. This** seal jaw 10 has [~~the~~] **a** flat operation surface 102

like the seal jaw shown in Fig. ~~[1.On]~~ **1. On** the other hand, the operation surface 112 ~~[facing]~~ **on the counter jaw 11 which faces** the packaging laminated material 1 is ~~[provided in the counter jaw 11, and the slope of a cross-sectional chevron-shape is provided in this operation surface.When pressuring]~~ **sloped so that the cross-sectional shape of the operation surface 112 is chevron-shaped. During pressing of** the packaging laminated materials 1 and 1 by the seal jaw 10 and the counter jaw 11, this ~~[slope]~~ **sloping operation surface 112** removes the seal prevention impurity, which may remain in the seal zone, from this seal zone, and ~~[a slope]~~ **the sloping surface** mixes the impurity with the packaging material **that is** melted or softened in the seal ~~[zone.Although]~~ **zone. Although** the mechanism is not necessarily clear, since the operation surface ~~[inclines]~~ **is inclined**, the power of the pressure of packaging laminated material inclines, and when innermost thermoplastic material is still in a solid state, a content residual substance is pushed out by innermost thermoplastic material from the seal ~~[zone.The]~~ **zone. The** surface oxide and the content residual substance are pushed out from the seal zone in the softening/melting stage of **the** innermost thermoplastic material, **and** are mixed with the thermoplastic ~~[material.In addition, this mechanism does not limit the scope of this invention.As shown in the right figure]~~ **material. In addition, the scope of the present invention is not limited to this mechanism. As shown in the right-hand portion** of Fig. 4, two packaging laminated ~~[material is]~~ **materials are** sealed by ~~[the]~~ pressure and heating, the seal zones 20 and 20 containing a cutting predetermined zone are formed, and, subsequently, a knife etc. cuts the cutting

predetermined zone ~~[21.Fig. 5 illustrating the 3rd example shows the seal steps at the time of]~~**21.**

[0032] **Fig. 5 illustrates a third example of the device of this invention for** sealing two packaging laminated materials 1 and 1 ~~[by the example of device by this invention.The]~~**. The** thermoplastic innermost layers of two packaging laminated materials 1 and 1 (or two portions of the same folded-up packaging laminated material) **are positioned** counter to each other in order to be ~~[sealed.The]~~ **sealed. The** packaging laminated materials are pushed **together** by the seal jaw 10 and the counter jaw 11. ~~[]~~The horn for forming a seal zone by ultrasonic heating is arranged in the seal jaw 10, and the seal jaw 10 has the flat operation surface 102.

[0033] On the other hand, the operation surface 112 ~~[facing]~~ **provided on the counter jaw 11 which faces** the packaging laminated materials 1 and 1 ~~[is provided in the counter jaw 11, and the slope of a cross-sectional chevron-shape is provided in this operation surface.When this slope pressures]~~**. This operation surface 112 is sloped to possess a chevron-shaped cross-section. When this sloped surface presses** two packaging laminated material 1 and 1 by the seal jaw 10 and the counter jaw 11, the seal prevention impurity which may remain in a seal zone is removed from the seal zone, and the melting/softening packaging material of the seal zone is mixed with the ~~[impurity.Since]~~ **impurity. Since** the operation surface ~~[inclines]~~ **is inclined**, the pressure power **applied** to **the** packaging laminated material ~~[inclines,]~~ **is inclined,** and when **the** innermost thermoplastic material is still in a solid state, a content residual substance is pushed out from ~~[a]~~ **the** seal zone by the solid

innermost [~~layer.In~~] **layer. In** the softening/melting stage of **the** innermost thermoplastic material, a surface oxide and a content residual substance are mixed with **the** softening/melting thermoplastic material, and are pushed out from the seal zone.

[0034] As shown in the right [~~figure~~]-**hand side** of Fig. 5, two packaging laminated materials are sealed by [~~the~~] pressure and heating, the seal zones 20 and 20 containing a cutting predetermined zone are formed, and, subsequently a knife, etc., cuts the cutting predetermined zone [~~21.Fig. 6 illustrating the 4th example shows the seal steps of~~]**21.**

[0035] **Fig. 6 illustrates a fourth example of the sealing device of the invention for sealing** the packaging laminated materials 1 and 1 [~~by the example of device by this invention.The~~]**. The** thermoplastic innermost layers of **the** two packaging laminated materials 1 and 1 (or two portions of the same folded-up packaging laminated material) **that are to be sealed are positioned** counter to each other [~~to be sealed.The~~]**. The** packaging laminated materials are pushed by the seal jaw 10 and the counter jaw 11.

[0036] The resistance 101 which forms a seal zone 10 by conduction heating is arranged in the seal jaw, and the seal jaw 10 has [~~the~~] **a** flat operation surface [~~102.The~~] **102. The** operation surface 112 which [~~counters~~] **is positioned counter to** the packaging laminated material 1 is provided in the counter jaw 11[~~, and the slope of a cross-sectional~~]**. This operation surface possesses a cross-section having a sloping** straight line shape [~~is provided in the operation surface.When the~~

~~slope~~] **from one end of the surface to the other as shown in Fig. 6. When the sloped surface** pushes the packaging laminated materials 1 and 1 by the seal jaw 10 and the counter jaw 11, the seal prevention impurity which may remain in the seal zone is removed from this seal zone, and the melting/softening packaging material of ~~[a]~~ **the** seal zone is mixed with the ~~[impurity.Since]~~ **impurity. Since** the operation surface ~~[inclines]~~ **is inclined**, the pressure power ~~[of]~~ **applied to the** packaging laminated material ~~[inclines]~~ **is inclined**, and when innermost thermoplastic material is still in a solid state, a content residual substance is pushed out by the solid innermost layer from the seal ~~[zone.In]~~ **zone. In** the softening/melting stage of innermost thermoplastic material, ~~[a]~~ surface oxide and ~~[a]~~ content residual substance are mixed with the softening/melting thermoplastic material, and/or are pushed out from the seal ~~[zone.In addition, this mechanism does not limit the scope of this invention.As shown in the right figure of Fig. 6,]~~**zone. In addition, the invention is not limited to this mechanism.**

[0037] **As shown in the right-hand side of Fig. 6, the** packaging laminated material is sealed by ~~[the]~~ pressure and heating, the seal zones 20 and 20 containing a cutting predetermined zone are formed, and, subsequently the zone is cut by the knife, etc., in the cutting predetermined zone ~~[21.Fig. 7 illustrating the 5th example is the]~~**21.**

[0038] **Fig. 7 illustrates a fifth example of the device of the invention which represents a** modification of the ~~[1st]~~ **first** example shown in Fig. ~~[1.Although]~~ **1. In** the ~~[1st]~~ **first** example**, the counter jaw** has one ridge, ~~[a]~~ **whereas in the firth**

example shown in Fig. 5 the counter jaw 11 has two ridges ~~[111,111 to]~~ **111, 111 at** the operation surface 112 ~~[in this 5th example.Since the 5th]~~**. Since the fifth** example has two ridges, ~~[the 3rd]~~ **a third** accumulation portion ~~[(not shown)]~~ is formed between the two ridges ~~[111,111.In]~~ **111, 111. In** this accumulation portion, the seal prevention impurity is mixed with melting/softening thermoplastic material, and the accumulation ~~[prevents such]~~ **portion inhibits** seal prevention.

~~[By]~~

[0039] **With the** formation of this ~~[3rd]~~ **third** accumulation portion, **the** seal intensity is strengthened, the removal distance of a seal prevention impurity is shortened, and a quicker seal is made possible.

~~[Fig. 8 illustrating the 6th example is the]~~

[0040] **Fig. 8 illustrates a sixth example of the device of the present invention which represents a** modification of the ~~[2nd]~~ **second** example shown in Fig. ~~[4.Although the 2nd example has a singular cross-sectional chevron-shape, in this 6th example, a]~~ **4. In the second example the cross-section of the operation surface possesses a single chevron-shaped element, whereas in this sixth example, the** counter jaw 11 has two chevron-~~[shapes to]~~ **shaped elements at** the operation surface 112. The ~~[6th]~~ **sixth** example is the same as the ~~[2nd]~~ **second** example in ~~[general.Since it]~~ **general. Since the sixth example** has two chevron-~~[shapes]~~ **shaped elements**, the mixed portion (not shown) of a thermoplastic material is formed between ~~[this]~~ **these** two chevron-~~[shape.In]~~ **shaped elements. In** this mixed portion, seal prevention impurity is mixed with

melting/softening thermoplastic material, and the mixed portion ~~[prevents]~~ **avoids** seal ~~[prevention.Like]~~ **prevention. Like** the formation of the ~~[3rd above-mentioned]~~**third** accumulation portion **mentioned above in connection with Fig. 5**, by the formation of the mixed portion, seal intensity is strengthened, removal/move distance of a seal prevention impurity is shortened, and a quicker seal is made ~~[possible.The]~~ **possible.**

[0041] **Based on the above-described embodiments of the present invention, the** following advantages are shown by the seal device and the filling machine of this invention ~~[so that clearly from the above-mentioned example.(1)]~~**.** Even if the packaging material contains ~~[the]~~ **a** thermoplastic layer polluted by impurities, the seal performances can have the desired strength and the desired liquid ~~[tight.(2) Even]~~ **tight characteristics. In addition,** if the packaging materials are sealed under the liquid surface of ~~[any]~~ **a** liquid food, ~~[any]~~ **and** seal prevention residual substance can be removed from the surface of the thermoplastic layers, and/or the seal prevention residual substance can be well ~~[mixed.(3) Even]~~ **mixed. Also,** if the packaging laminated material is covered with ~~[the]~~ residual substance of the oxide and the content**,** etc., the bad influence ~~[of]~~ **associated with** such ~~[a]~~ seal prevention impurity can be reduced, and ~~[the]~~ **a** possible optimum seal **can** be obtained.

~~[(4)]~~

[0042] In the seal jaw and counter jaw in the packaging system, the main function of ~~[a]~~ **the** counter jaw is ~~[a]~~ **to apply** pressure and the function of ~~[a]~~ **the** counter jaw has been recognized ~~[that the importance of a function is low]~~**to be of low**

importance compared with the seal ~~[jaw.However]~~ **jaw. However**, the working efficiency and cost performance are optimized by decentralizing ~~[a]~~ **the** function to ~~[a]~~ **the** seal jaw and ~~[a]~~ **the** counter ~~[jaw.(5)]~~ **jaw.** Stagnant content liquid is not formed in the seal zone, and contents liquid such as juice does not adhere hygienically to the cross section of a seal ~~[zone.(6)]~~ **zone.** Since the seal jaw has a flat operation surface, the generating high frequency magnetic field is uniform and smooth in heat-healing by the high frequency induction heating with the inductor of the seal ~~[jaw.Morcover]~~ **jaw. Moreover**, when heat-healing by ultrasonic heating using the horn of a seal jaw, there is no unevenness in a horn surface, uniform heating can be enabled, and ~~[the]~~ **a** seal which does not have the worn-out crack of a heat-sealing surface, and roughness ~~[further]~~ can be **further** obtained.

~~[Availability on industry]~~

[0043] The heat-sealing device ~~[by]~~ **of** this invention and its filling machine **are used to** manufacture ~~[the]~~ packaging ~~[container]~~ **containers** filled with liquid food, such as milk and ~~[a fruits drink]~~ **fruit drinks**, from a packaging material web.

FIELD OF THE INVENTION

[0001] This invention relates to a device which heat-seals tube shaped packaging material fabricated from a packaging material web in the transverse direction, and a filling machine utilizing this heat-sealing device to manufacture a packaging container filled with fluid food.

BACKGROUND OF THE INVENTION

[0002] A filled packaging container used for milk, fruits drink, etc. is generally made from laminated packaging material. The packaging material has a comparatively rigid main supporting layer covered with thin layers of plastic materials. This material can also contain materials such as aluminum foil. The common feature of this type of packaging laminated material is that the thermoplastic material (usually polyethylene) layer provided on the outside and inside of the laminated material is used to form a seal in a liquid tight state with heat and pressure. In order for a seal to have a desired strength and a desired liquid tight performance, both thermoplastic layers that are to be sealed should be clean, and should not include impurities. With a clean layer, sufficient melting of each thermoplastic layer can be obtained and, as a result, the optimum seal can be achieved by strong high sealing performance. Since impurities of the thin oxide formed on the packaging laminated material during the extrusion steps of thermoplastic layers usually exist in the thermoplastic layer, a perfect melting between the thermoplastic layers is occasionally prevented. Therefore, a seal cannot

acquire the necessary strength and sealing performance. Moreover, when sealing packaging materials under liquid food, impurities associated with residual substances of the contents (liquid food) which hinders the sealing further may also be generated or present on the surface of the thermoplastic layer. This is a problem peculiar to the packaging filling system in which sealing of the laminated material is performed under the liquid surface of the liquid food. That is, in this packaging filling system, the content food must be first pushed out from the crevice between the surfaces of the thermoplastic materials before sealing.

[**0003**] However, as a practical matter, a very small quantity of residual substance remains, without the content food being completely squeezed out, and this residual substance weakens the seal.

SUMMARY OF THE INVENTION

[**0004**] The invention involves a device which can heat-seal the above-mentioned packaging laminated material so that all the above-mentioned problems may be avoided, and thereby provide optimum seal performance. The invention also provides a device which heat-seals the packaging laminated material to avoid the bad influence of seal prevention impurities as much as possible, while making an optimum seal possible, even if the packaging laminated material is covered with an oxide, the residual substance of the packaging content, or impurities.

[**0005**] The heat-sealing device heat-seals a tube shaped packaging material in the transverse direction under the surface of the liquid food. The tube-shaped packaging

material is packaging material formed into the tube shape from a packaging material web, with the liquid food being filled up in this tube. The heat-sealing device pushes this tube from its outside by the seal jaw and the counter jaw, and heat-seals the tube in the transverse direction of the tube. The device heat-seals the seal zone of the packaging material containing a cutting predetermined zone under the surface of the liquid food. The operation surface of the seal jaw in contact with the seal zone has a substantially flat surface. The operation surface of the counter jaw includes a removal/mixture means. The removal/mixture means removes from the seal zone seal prevention impurity which may remain in the tube, and/or mixes the impurity with the melted or softened packaging material in the seal zone.

[**0006**] In a preferred form of this invention, the removal/mixture means may be a slope provided in the operation surface of the counter jaw. The slope may be in the form of a chevron-shaped operation surface of the counter jaw. In another preferred form of this invention, the removal/mixture means can be ridges continuously or discontinuously provided in the operation surface of the counter jaw. An inductor for forming a seal zone by high frequency induction heating may be arranged in the seal jaw, and the packaging material may comprise a metal thin layer and a thermoplastic material innermost layer.

[**0007**] In another preferred embodiment of this invention, a horn for forming a seal zone by ultrasonic heating may be arranged in the seal jaw, and the packaging material may comprise at least a thermoplastic material innermost layer. In another version of this invention, an electrical-resistor for forming a seal zone by heating is

provided in the seal jaw, and the packaging material may have at least a thermoplastic material innermost layer.

[0008] The filling machine of this invention forms a packaging material web into a tube shape, fills up liquid food in the tube, and heat-seals and cuts the tube shape packaging material in the transverse direction. The filling machine of this invention utilizes the heat-sealing device mentioned above.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

[0009] Fig. 1 is a cross-sectional view showing the structure and operation of the heat-sealing device according to a first example of this invention;

[0010] Fig. 2 is a sectional view of the packaging material used for the heat-sealing device of this invention;

[0011] Fig. 3 is an outline figure showing the structure and operation of the filling machine equipped with the heat-sealing device of this invention;

[0012] Fig. 4 is a cross-sectional view showing the structure and operation of the heat-sealing device according to a second example of this invention;

[0013] Fig. 5 is a cross-sectional view showing the structure and operation of the heat-sealing device according to a third example of this invention;

[0014] Fig. 6 is a cross-sectional view showing the structure and operation of the heat-sealing device according to a fourth example of this invention;

[0015] Fig. 7 is a cross-sectional view showing the structure of the counter jaw of the heat-sealing device according to a fifth example of this invention; and

[0016] Fig. 8 is a cross-sectional view showing the structure of the counter jaw of the heat-sealing device according to a sixth example of this invention.

DETAILED DESCRIPTION OF THE INVENTION

[0017] Hereafter, although the examples about the heat-sealing device according to this invention are described based on the drawings, this invention is not limited to the examples indicated by these drawings. The outline of an example of the filling machine equipped with the heat-sealing device of this invention is shown in Fig. 3. The filling machine shown in this example is operated as follows. From a roll, a filling machine unwinds the packaging material web 1, which comprises a thermoplastic material layer as an innermost layer, and conveys the web to the inside of the filling machine with rollers. The filling machine seals the strip tape 2 to the end of the packaging material web through operation of a strip tape applicator 3, and sterilizes the packaging material web by passing it through the inside of the sterilization agent bath 4. The filling machine removes the sterilization agent with an air-knife 5, and forms the web into a tubular shape with forming rollers 6. The tube is filled up with liquid food from a filling pipe 7 extending into the tube, and is sealed by a longitudinal seal element 8 in the longitudinal direction of the tube. To advance the tube below by a length equivalent to one packaging container, the tube is pushed by seal jaws 10 and counter jaws 11 forming the heat-sealing device of this invention, and the filling machine heat-seals the tube in the transverse direction, and continuously forms pillow-shaped packaging containers 12 simultaneously.

Then, a predetermined zone of the seal zone of the pillow-shaped packaging container is cut with a knife to separate each packaging container 13, and the flaps of the upper and lower sides of the separated container are folded to form the packaging container 11 having the final shape with a final holder 14.

[0018] An example of the packaging material 1 which can be used in this invention is shown in Fig. 2. This packaging material has the illustrated layer structure, and consists of a thermoplastic material layer 31 forming an outermost layer, a paper layer 32, a metal layer 33 forming an oxygen barrier layer, and a thermoplastic material layer 34 forming an innermost layer.

[0019] The packaging material used in this invention is not limited to the above-mentioned example, but various packaging material can be used. For example, packaging laminates can be used that contain low-density polyethylene (LDPE)/ printing ink layer/paper (fibrous) substrate layer/LDPE/aluminum foil/LDPE/LDPE, LDPE/printing ink layer/paper substrate layer/LDPE/LDPE, printing ink layer/LDPE/paper substrate layer/LDPE/LDPE, and LDPE/a printing ink layer/paper substrate layer/LDPE/aluminum/polyester (PET).

[0020] Moreover, the ethylene alpha olefin copolymer (the so-called metallocene PE) which polymerized using the single site catalyst can also be used as the innermost layer or/ and outermost layer in addition to the LDPE mentioned above.

[0021] Furthermore, the vapor deposited layer of an inorganic oxide can also be used as a practical substitute for the metal layer (aluminum foil) as the above-mentioned oxygen barrier layer.

[**0022**] Fig. 1 shows the seal device of this invention in cross-section with the heat-healed packaging material 1. The main part of the seal jaw 10 is made from a non-conductive material, and contains the cylindrical inductor 101 of a conductive material, for example, copper.

[**0023**] The inductor 101 is located in the center of the main part forming the operation surface 102 of the seal jaw 10. The formed operation surface is a substantially flat surface. This inductor 101 is arranged to form the seal zone by high frequency induction heating. The packaging material in this case is a laminate which comprises the thin metal layer and the thermoplastic material innermost layer. In this high frequency induction heating, a magnetic field occurs around the coil which is connected to a high frequency power supply. An eddy current arises in the metal foil of the coil circumference, and Joule heat is generated by this eddy current and the resistance of the metal foil layer. The generated Joule heat is transmitted to the thermoplastic material innermost layer which faces the metal foil layer, and melts this thermoplastic material layer. In this example, an inductor 101 corresponds to a part of coil of the above-mentioned high frequency induction heating. Other portions (not shown) of the coil can be arranged at the reverse side of an inductor 101 or to the exterior of the seal jaw 10, etc. In this invention, the operation surface 102 of the seal jaw 10 facing the seal zone 20 comprises a substantially flat surface. The operation surface 111 of the counter jaw 11 possess a removal/mixture means.

[**0024**] The removal/mixture means removes seal prevention impurity from the seal zone 20, and mixes the impurity with the melted or softened (melted/softened) packaging material in the seal zone 20. In the case of this example, removal/mixture means is the ridge 111 continuously or discontinuously provided in the operation surface 112 of this counter jaw. The ridge 111 which projects from the operation surface 112 is provided in the counter jaw 11. The cross-sectional shape of this ridge 111 is mostly rectangular. The height of the ridge is 0.2 to 0.8 times the thickness of laminated material, preferably 0.5 times. The width is almost equal to the width of packaging laminated material. The ridge is not limited to this example, for example it can include a ridge with a round top, a ridge having a trapezoidal cross-section, etc.

[**0025**] The operation surface 102 of the seal jaw 10 contains the central zone which heats the laminated material 1. The counter jaw 11 includes the ridge 111 and the adjoining zones of the ridge. To enable high frequency welding of the laminated material 1 containing aluminum foil, the high frequency power supply is connected with an inductor 101, which heats the laminated material. When sealing together packaging laminated material which does not contain aluminum foil (metal layer 33) or other conductive layers, the laminated material heating zone may consist of, for example, resistance material. The seal device of this invention may modify this by various methods within the limits of the concept of this invention, in order to fulfill the necessary condition of sealing different packaging containers and materials. In this example, the tube of packaging material is sealed in the transverse direction to

form a seal zone, and the seal zone is cut by cutting a predetermined zone 21 in the seal zone. A knife (or a certain other suitable cutting devices) operates in the predetermined zone 21. Moreover, in this example, the eddy current by the oscillating magnetic field is induced in the aluminum (metal) layer 33 of the packaging laminated material 1. The aluminum (metal) layer 33 is heated ro a temperature higher than the melting point of the adjoining thermoplastic layer in the zone corresponding to the surface of the inductor 101. The generated heat is directly transmitted to the thermoplastic layers 34 and 34 located between the aluminum layers 33 and 33, and melts the thermoplastic layer which is changed to a fluid. By virtue of the high pressure (approximately 100kg/cm^2) at which the ridge 111 pushes the packaging laminated material, the melted thermoplastic material runs and flows to the zones 20 and 20 from the high-pressure zone 21 of the seal zone. The thermoplastic layers 34 and 34 which are counter to each other and located in the zone outside the seal zones 20 and 20 maintain a solid state, and are pushed, countering to each other. Without flowing out outside further, the melted thermoplastic material stops in the zone shown by reference number 20 in the seal zone, and forms the high-pressure zone 21 and the accumulation zones 20 and 20. The two layers are mixed and sealed to each other in an accumulation portion (zones 20 and 20).

[0026] The excess of the plastic that is well mixed at the accumulation portions (zones) 20 and 20 formed in the seal zone is included, and a seal of practically sufficient strength is obtained between the two layers.

[**0027**] Since the flow by the high pressure is very quick, the mixture of sufficient plastic material from between the two layers is guaranteed by the turbulent flow generated in the flowing plastic material.

[**0028**] Therefore, residual substances of the oxide and the liquid food content existing in the surface is effectively mixed within the plastic, and a film of impurities which might adversely affect the strength of the seal does not remain.

[**0029**] The seal device of this invention can be modified by various methods within the limits of the concept of this invention in order to fulfill the necessary condition of the seals of packaging containers.

[**0030**] Although the material forming the ridge in the above-mentioned example is hard in order to resist deformation associated with the pressure during the sealing step, the ridge may be made of a deformable elastic material. In this case, although the same seal zones 20 (accumulation portion) as above cannot be significantly formed between laminated packaging materials, a higher pressure can be made from a ridge portion. The seal prevention impurity which may remain in the seal zone is removed from the seal zone, and in the seal zone, melted or softened packaging material can be mixed.

[**0031**] Fig. 4 illustrates a second example showing the seal steps at the time of sealing two packaging laminated materials 1 and 1 through use the device of this invention. Two packaging laminated materials 1 and 1 (or two facing portions of the same folded-up packaging laminated material) are sealed, particularly the thermoplastic layers of those innermost layers. The counter jaw 11 and the seal jaw

10 push together the packaging laminated materials. This seal jaw 10 has a flat operation surface 102 like the seal jaw shown in Fig. 1. On the other hand, the operation surface 112 on the counter jaw 11 which faces the packaging laminated material 1 is sloped so that the cross-sectional shape of the operation surface 112 is chevron-shaped. During pressing of the packaging laminated materials 1 and 1 by the seal jaw 10 and the counter jaw 11, this sloping operation surface 112 removes the seal prevention impurity, which may remain in the seal zone, from this seal zone, and the sloping surface mixes the impurity with the packaging material that is melted or softened in the seal zone. Although the mechanism is not necessarily clear, since the operation surface is inclined, the power of the pressure of packaging laminated material inclines, and when innermost thermoplastic material is still in a solid state, a content residual substance is pushed out by innermost thermoplastic material from the seal zone. The surface oxide and the content residual substance are pushed out from the seal zone in the softening/melting stage of the innermost thermoplastic material, and are mixed with the thermoplastic material. In addition, the scope of the present invention is not limited to this mechanism. As shown in the right-hand portion of Fig. 4, two packaging laminated materials are sealed by pressure and heating, the seal zones 20 and 20 containing a cutting predetermined zone are formed, and, subsequently, a knife etc. cuts the cutting predetermined zone 21.

[**0032**] Fig. 5 illustrates a third example of the device of this invention for sealing two packaging laminated materials 1 and 1. The thermoplastic innermost layers of

two packaging laminated materials 1 and 1 (or two portions of the same folded-up packaging laminated material) are positioned counter to each other in order to be sealed. The packaging laminated materials are pushed together by the seal jaw 10 and the counter jaw 11. The horn for forming a seal zone by ultrasonic heating is arranged in the seal jaw 10, and the seal jaw 10 has the flat operation surface 102.

[0033] On the other hand, the operation surface 112 provided on the counter jaw 11 which faces the packaging laminated materials 1 and 1. This operation surface 112 is sloped to possess a chevron-shaped cross-section. When this sloped surface presses two packaging laminated material 1 and 1 by the seal jaw 10 and the counter jaw 11, the seal prevention impurity which may remain in a seal zone is removed from the seal zone, and the melting/softening packaging material of the seal zone is mixed with the impurity. Since the operation surface is inclined, the pressure power applied to the packaging laminated material is inclined, and when the innermost thermoplastic material is still in a solid state, a content residual substance is pushed out from the seal zone by the solid innermost layer. In the softening/melting stage of the innermost thermoplastic material, a surface oxide and a content residual substance are mixed with the softening/melting thermoplastic material, and are pushed out from the seal zone.

[0034] As shown in the right-hand side of Fig. 5, two packaging laminated materials are sealed by pressure and heating, the seal zones 20 and 20 containing a cutting predetermined zone are formed, and, subsequently a knife, etc., cuts the cutting predetermined zone 21.

[**0035**] Fig. 6 illustrates a fourth example of the sealing device of the invention for sealing the packaging laminated materials 1 and 1. The thermoplastic innermost layers of the two packaging laminated materials 1 and 1 (or two portions of the same folded-up packaging laminated material) that are to be sealed are positioned counter to each other. The packaging laminated materials are pushed by the seal jaw 10 and the counter jaw 11.

[**0036**] The resistance 101 which forms a seal zone 10 by conduction heating is arranged in the seal jaw, and the seal jaw 10 has a flat operation surface 102. The operation surface 112 which is positioned counter to the packaging laminated material 1 is provided in the counter jaw 11. This operation surface possesses a cross-section having a sloping straight line shape from one end of the surface to the other as shown in Fig. 6. When the sloped surface pushes the packaging laminated materials 1 and 1 by the seal jaw 10 and the counter jaw 11, the seal prevention impurity which may remain in the seal zone is removed from this seal zone, and the melting/softening packaging material of the seal zone is mixed with the impurity. Since the operation surface is inclined, the pressure power applied to the packaging laminated material is inclined, and when innermost thermoplastic material is still in a solid state, a content residual substance is pushed out by the solid innermost layer from the seal zone. In the softening/melting stage of innermost thermoplastic material, surface oxide and content residual substance are mixed with the softening/melting thermoplastic material, and/or are pushed out from the seal zone. In addition, the invention is not limited to this mechanism.

[0037] As shown in the right-hand side of Fig. 6, the packaging laminated material is sealed by pressure and heating, the seal zones 20 and 20 containing a cutting predetermined zone are formed, and, subsequently the zone is cut by the knife, etc., in the cutting predetermined zone 21.

[0038] Fig. 7 illustrates a fifth example of the device of the invention which represents a modification of the first example shown in Fig. 1. In the first example, the counter jaw has one ridge, whereas in the firth example shown in Fig. 5 the counter jaw 11 has two ridges 111, 111 at the operation surface 112. Since the fifth example has two ridges, a third accumulation portion is formed between the two ridges 111, 111. In this accumulation portion, the seal prevention impurity is mixed with melting/softening thermoplastic material, and the accumulation portion inhibits seal prevention.

[0039] With the formation of this third accumulation portion, the seal intensity is strengthened, the removal distance of a seal prevention impurity is shortened, and a quicker seal is made possible.

[0040] Fig. 8 illustrates a sixth example of the device of the present invention which represents a modification of the second example shown in Fig. 4. In the second example the cross-section of the operation surface possesses a single chevron-shaped element, whereas in this sixth example, the counter jaw 11 has two chevron-shaped elements at the operation surface 112. The sixth example is the same as the second example in general. Since the sixth example has two chevron-shaped elements, the mixed portion (not shown) of a thermoplastic material

is formed between these two chevron-shaped elements. In this mixed portion, seal prevention impurity is mixed with melting/softening thermoplastic material, and the mixed portion avoids seal prevention. Like the formation of the third accumulation portion mentioned above in connection with Fig. 5, by the formation of the mixed portion, seal intensity is strengthened, removal/move distance of a seal prevention impurity is shortened, and a quicker seal is made possible.

[**0041**] Based on the above-described embodiments of the present invention, the following advantages are shown by the seal device and the filling machine of this invention. Even if the packaging material contains a thermoplastic layer polluted by impurities, the seal performances can have the desired strength and the desired liquid tight characteristics. In addition, if the packaging materials are sealed under the liquid surface of a liquid food, and seal prevention residual substance can be removed from the surface of the thermoplastic layers, and/or the seal prevention residual substance can be well mixed. Also, if the packaging laminated material is covered with residual substance of the oxide and the content, etc., the bad influence associated with such seal prevention impurity can be reduced, and a possible optimum seal can be obtained.

[**0042**] In the seal jaw and counter jaw in the packaging system, the main function of the counter jaw is to apply pressure and the function of the counter jaw has been recognized to be of low importance compared with the seal jaw. However, the working efficiency and cost performance are optimized by decentralizing the function to the seal jaw and the counter jaw. Stagnant content liquid is not formed

in the seal zone, and contents liquid such as juice does not adhere hygienically to the cross section of a seal zone. Since the seal jaw has a flat operation surface, the generating high frequency magnetic field is uniform and smooth in heat-healing by the high frequency induction heating with the inductor of the seal jaw. Moreover, when heat-healing by ultrasonic heating using the horn of a seal jaw, there is no unevenness in a horn surface, uniform heating can be enabled, and a seal which does not have the worn-out crack of a heat-sealing surface, and roughness can be further obtained.

[**0043**] The heat-sealing device of this invention and its filling machine are used to manufacture packaging containers filled with liquid food, such as milk and fruit drinks, from a packaging material web.

Specification

Heat-sealing device

Technical field

This invention relates to the device which heat-heals the tube shape packaging material fabricated from the packaging material web in the transversal direction, and the filling machine which manufactures the packaging container filled up with fluid food, and has this heat-sealing device.

Background art

A filled packaging container is used for milk, a fruits drink, etc., and, generally is made from laminated packaging material.
Packaging material has the comparatively rigid main supporting layer covered with the thin layers of plastic materials.
This material can also contain the material of aluminum foil or others.
The common feature of this type of all packaging laminated material is that the thermoplastic material (usually polyethylene) layer provided an outside and inside laminated material seals two portions of the laminated material which countered to each other in the liquid tight state with heat and pressure.
In order for a seal to have desired strength and a desired liquid tight performance, both two thermoplastic layers to seal are surely clean, and it is required not to include impurities.
In such case of the clean layer, sufficient melting of each thermoplastic layer can be obtained and, as a result, the optimum seal is brought by strong high sealing performance.
Since the impurities of the thin oxide formed on packaging laminated material during extrusion steps of thermoplastic layers usually exist in a thermoplastic layer, the perfect melting between thermoplastic layers is alike occasionally, and is blocked
Therefore, a seal cannot acquire possible strength and possible sealing performance.
Moreover, when sealing packaging materials under the surface of liquid food, the impurity of the residual substance of the content (liquid food) which hinders the sealing further may also be generated on the surface of a thermoplastic layer.
This is a problem peculiar to the packaging filling system that the seal of laminated material is performed under the liquid surface of liquid foods.
That is, in this packaging filling, the content food must be first pushed out from the crevice

between the surfaces of thermoplastic materials before sealing.
However, as a practical question, the residual substance of very small quantity remains, without squeezing out content food completely, and this residual substance weakens the seal.

Disclosure of the invention

The purpose of this invention is offering the device which can heat-heal the above-mentioned packaging laminated material so that all the above-mentioned problems may be avoided, having the optimum seal performance.
The further purpose of this invention is offering the device which heat-heals the packaging laminated material which can lose the bad influence of such a seal prevention impurity as much as possible, and makes the optimum seal possible, even if packaging laminated material is covered with an oxide, the residual substance of a packaging content, or impurities.
The above-mentioned subject is solved by the heat-sealing device according to this invention.
The heat-sealing device heat-heals a tube shape packaging material in the transversal direction under the surface of liquid food. Tube shape packaging material is packaging material with which it is formed by the tube shape from a packaging material web, and liquid food is filled up in this tube.
The device pushes this tube from its outside by the seal jaw and the counter jaw, and heat-heal the tube in the transversal direction of the tube. The device heat-heals the seal zone of the packaging material containing a cutting predetermined zone under the surface of liquid food.
The operation surface of the seal jaw in contact with the seal zone has a substantially flat surface.
The operation surface of the counter jaw is characterized by having removal/mixture means.
The removal/mixture means removes the seal prevention impurity which may remain in the tube of a seal zone from this seal zone, and/or mixes the impurity with the melted or softened packaging material in the seal zone.
In the preferable embodiment of this invention, removal/mixture means may be the slope provided in the operation surface of the counter jaw.
In the preferable embodiment of this invention, removal/mixture means may be the slope of a cross-sectional chevron-shape provided in the operation surface of the counter jaw.
In a preferable embodiment of this invention, removal/mixture means can be ridges continuously or discontinuously provided in the operation surface of the counter jaw.

In the preferable embodiment of this invention, the inductor for forming a seal zone by the high frequency induction heating may be arranged in the seal jaw, and the packaging material may comprise a metal thin layer and a thermoplastic material innermost layer.
In the preferable embodiment of this invention, the horn for forming a seal zone by ultrasonic heating may be arranged in the seal jaw, and the packaging material may comprise at least a thermoplastic material innermost layer.
In the preferable embodiment of this invention, electrical - resistor for forming a seal zone by heating is provided in the seal jaw, and packaging material may have at least a thermoplastic material innermost layer.
The filling machine by this invention forms a packaging material web to a tube shape, fills up with liquid food in the tube, heat-heals and cuts the tube shape packaging material in the transversal direction. The filling machine by this invention is characterized by having the heat-sealing device by this above-mentioned invention.

Brief description of the accompanying drawings

Fig. 1 is a sectional view showing the structure and operation of the heat-sealing device of the 1st example by this invention.
Fig. 2 is a sectional view of the packaging material used for the heat-sealing device of this invention.
Fig. 3 is an outline figure showing the structure and operation of the filling machine equipped with the heat-sealing device by this invention.
Fig. 4 is a sectional view showing the structure and operation of the heat-sealing device of the 2nd example by this invention.
Fig. 5 is a sectional view showing the structure and operation of the heat-sealing device of the 3rd example by this invention.
Fig. 6 is a sectional view showing the structure and operation of the heat-sealing device of the 4th example by this invention.
Fig. 7 is a sectional view showing the structure of the counter jaw of the heat-sealing device of the 5th example by this invention.
Fig. 8 is a sectional view showing the structure of the counter jaw of the heat-sealing device of the 6th example by this invention.

Detailed description of the invention

Hereafter, although the examples about the heat-sealing device according to this invention are described based on the drawings, this invention is not limited to the examples indicated

by these drawings.

The outline of an example of the filling machine equipped with the heat-sealing device by this invention is shown in Fig. 3.

The filling machine shown in this example is operated as follows.

From a roll, a filling machine unwinds the packaging material web 1 which comprises a thermoplastic material layer in an innermost layer, and conveys the inside of the filling machine with rollers.

The filling machine seals the strip tape 2 to the end of the packaging material web by the strip tape applicator 3, and sterilizes the packaging material web which passes through the inside of the sterilization agent bath 4.

The filling machine removes the sterilization agent with an air-knife 5, and forms it to a tube shape with forming rollers 6.

It fills up with liquid food from a filling pipe 7 in the tube, and seals a longitudinal seal element 8 in the direction of longitudinal in the tube. Sending this tube below by the length equivalent to one packaging container, the tube is pushed by seal jaws 10 and counter jaws 11 of heat-sealing device of this invention, and the filling machine heat-heals the tube in the transversal direction, and forms it continuously in the pillow-shaped packaging container 12 simultaneously.

Then, a cutting predetermined zone of the seal zone of the pillow-shaped packaging container is cut, and the filling machine separates with a knife in each packaging container 13, and flaps of the upper and lower sides of the separated container 14 are folded, and forms the packaging container 11 having a final shape with a final holder 14.

An example of the packaging material 1 which can be used in this invention is shown in Fig. 2.

This packaging material has the shown layer structure, and consists of a thermoplastic material layer 31 of an outermost layer, a paper layer 32, a metal layer 33 that is an oxygen barrier layer, and a thermoplastic material layer 34 of an innermost layer.

The packaging material in this invention is not limited to the above-mentioned example, but various packaging material can be used for it. For example, a packaging laminate contains low-density polyethylene (LDPE) / printing ink layer / paper (fibrous) substrate layer / LDPE / aluminum foil / LDPE/LDPE, LDPE / printing ink layer / paper substrate layer / LDPE/LDPE, printing ink layer / LDPE / paper substrate layer / LDPE/LDPE and LDPE / a printing ink layer / paper substrate layer / LDPE / aluminum / polyester (PET).

Moreover, the ethylene alpha olefin copolymer (the so-called metallocene PE) which polymerized using the single site catalyst can also be used for an innermost layer or/, and the outermost layer in addition to LDPE of the above.

Furthermore, the vapor deposited layer of an inorganic oxide can also be used as a

practical substitute which substitutes for the metal layer (aluminum foil) of the above-mentioned oxygen barrier layer.

Fig. 1 shows the seal device by this invention in section with the heat-healed packaging material 1.

The main part of the seal jaw 10 is made from an un-conductive material, and contains the cylindrical inductor 101 of a conductive material, for example, copper.

The inductor 101 located in the center of the operation surface of a main part forms the operation surface 102 of the seal jaw 10 with the circumference portion of the main part. The formed operation surface is a substantially flat surface. This inductor 101 is arranged in order to form the seal zone in the seal jaw 10 by the high frequency induction heating.

The packaging material in this case is a laminate which comprises the metal thin layer and the thermoplastic material innermost layer.

In this high frequency induction heating, a magnetic field occurs around the coil which connects with a high frequency power supply and passes high frequency current, an eddy current arises in the metal foil of the coil circumference, and the Joule heat is generated by this eddy current and the resistance of metal foil (layer).

The generated Joule heat is transmitted to the thermoplastic material innermost layer which faced the metal (foil) layer, and melts this thermoplastic material layer.

In this example, an inductor 101 corresponds to a part of coil of the above-mentioned high frequency induction heating. Other portions (not shown) of the coil can be arranged at the reverse side of an inductor 101 or to the exterior of the seal jaw 10 etc.

In this invention, the operation surface 102 of the seal jaw 10 facing the seal zone 20 comprises a substantially flat surface. The operation surface 111 of the counter jaw 11 has the removal/mixture means.

The removal/mixture means removes the seal prevention impurity from the seal zone 20, and mix the impurity with the melting or softening (melting/softening) packaging material in the seal zone 20.

In the case of this example, removal/mixture means is the ridge 111 continuously or discontinuously provided in the operation surface 112 of this counter jaw. The ridge 111 which projects from the operation surface 112 is provided in the counter jaw 11. The cross-sectional shape of this ridge 111 has a mostly rectangle. The height is 0.2 to 0.8 times the thickness of laminated material, preferably 0.5 times.

The width is almost equal to the width of packaging laminated material.

The ridge is not limited to this example, for example, it includes a ridge with a round top, a ridge of a cross-sectional trapezoid, etc.

The operation surface 102 of the seal jaw 10 contains the central zone which heats the laminated material 1. The counter jaw 11 has a ridge 111and the adjoining zones of the

ridge.

In order to enable high frequency welding of the laminated material 1 containing aluminum foil, the high frequency power supply is connected with an inductor 101, which heats laminated material.

When sealing the packaging laminated material which does not contain aluminum foil (metal layer 33) or other conductive layers together, the laminated material heating zone may consist of for example, resistance material.

The seal device by this invention may modify this by various methods within the limits of the concept of this invention, in order to fulfill the necessary condition of the seal of the different packaging containers and materials and.

In this example, the tube of packaging material is sealed in the transversal direction to form a seal zone, and the seal zone is cut by a cutting predetermined zone 21 in the seal zone. A knife (or a certain other suitable cutting devices) operates in the cutting predetermined zone 21.

Moreover, in this example, the eddy current by the oscillating magnetic field is induced in the aluminum (metal) layer 33 of the packaging laminated material 1.

The aluminum (metal) layer 33 is heated at the temperature higher than the melting point of the thermoplastic layer which adjoins in the zone corresponding to the surface of an inductor 101.

The generated heat is directly transmitted to the thermoplastic layer 34 and 34 located between the aluminum layers 33 and 33, melts a thermoplastic layer, and is changed to a fluid.

For the high pressure (approximately 100kg/cm^2) at which a ridge 111 pushes packaging laminated material, the melted thermoplastic material runs and flows to the zones 20 and 20 from the high-pressure zone 21of the seal zone.

The thermoplastic layers 34 and 34 which counter to each other and are located in the zone outside the seal zones 20 and 20 keep solid state, and they are pushed, countering to each other. Without flowing out outside further, the melted thermoplastic material stops in the zone shown by the reference number 20 in the seal zone, and forms the high-pressure zone 21 and the accumulation zones 20 and 20. Two layers mix and seal in an accumulation portion (zones 20 and 20) to each other.

The excess of the plastic well mixed at the accumulation portions (zones) 20 and 20 formed in the seal zone is included, and the seal of practically sufficient strength is obtained between two layers.

Since the flow by the high pressure is very quick, the mixture with a sufficient plastic material from between two layers which counter is guaranteed by the turbulent flow generated into the flowing plastic material.

Therefore, the residual substance of the oxide and the liquid food content which exists in the surface is effectively mixed within a plastic, and the film of the impurities which spoil the strength of the seal does not remain.

The seal device by this invention can be modified by various methods within the limits of the concept of this invention in order to fulfill the necessary condition of the seals of packaging containers.

Although the material of the ridge which is hard to deform by the pressure during the seal step in the above-mentioned example was used, a ridge may be a deformable elastic material. In this case, although the above seal zones 20 (accumulation portion) cannot be significantly formed between laminated packaging materials, a higher pressure can be made from a ridge portion.

The seal prevention impurity which may remain in the seal zone is removed from a seal zone, and in the seal zone, melted or softened packaging material can be mixed.

Fig. 4 illustrating the 2nd example shows the seal steps at the time of sealing two packaging laminated materials 1 and 1 by the example of device by this invention.

Two packaging laminated materials 1 and 1 (or two facing portions of the same folded-up packaging laminated material) are sealed between the thermoplastic layers of those innermost layers. The counter jaw 11 and the seal jaw 10 push packaging laminated materials.

This seal jaw 10 has the flat operation surface 102 like the seal jaw shown in Fig. 1.

On the other hand, the operation surface 112 facing the packaging laminated material 1 is provided in the counter jaw 11, and the slope of a cross-sectional chevron-shape is provided in this operation surface.

When pressuring the packaging laminated materials 1 and 1 by the seal jaw 10 and the counter jaw 11, this slope removes the seal prevention impurity, which may remain in the seal zone, from this seal zone, and a slope mixes the impurity with the packaging material melted or softened in the seal zone.

Although the mechanism is not necessarily clear, since the operation surface inclines, the power of the pressure of packaging laminated material inclines, and when innermost thermoplastic material is still in a solid state, a content residual substance is pushed out by innermost thermoplastic material from the seal zone.

The surface oxide and the content residual substance are pushed out from the seal zone in the softening/melting stage of innermost thermoplastic material, are mixed with the thermoplastic material.

In addition, this mechanism does not limit the scope of this invention.

As shown in the right figure of Fig. 4, two packaging laminated material is sealed by the pressure and heating, the seal zones 20 and 20 containing a cutting predetermined zone

are formed, and, subsequently a knife etc. cuts the cutting predetermined zone 21.
Fig. 5 illustrating the 3rd example shows the seal steps at the time of sealing two packaging laminated materials 1 and 1 by the example of device by this invention.
The thermoplastic innermost layers of two packaging laminated materials 1 and 1 (or two portions of the same folded-up packaging laminated material) counter to each other in order to be sealed.
The packaging laminated materials are pushed by the seal jaw 10 and the counter jaw 11.
The horn for forming a seal zone by ultrasonic heating is arranged in the seal jaw 10, and the seal jaw 10 has the flat operation surface 102.
On the other hand, the operation surface 112 facing the packaging laminated materials 1 and 1 is provided in the counter jaw 11, and the slope of a cross-sectional chevron-shape is provided in this operation surface.
When this slope pressures two packaging laminated material 1 and 1 by the seal jaw 10 and the counter jaw 11, the seal prevention impurity which may remain in a seal zone is removed from the seal zone, and the melting/softening packaging material of the seal zone is mixed with the impurity.
Since the operation surface inclines, the pressure power to packaging laminated material inclines, and when innermost thermoplastic material is still in a solid state, a content residual substance is pushed out from a seal zone by the solid innermost layer.
In the softening/melting stage of innermost thermoplastic material, a surface oxide and a content residual substance are mixed with softening/melting thermoplastic material, and are pushed out from the seal zone.
As shown in the right figure of Fig. 5, two packaging laminated materials are sealed by the pressure and heating, the seal zones 20 and 20 containing a cutting predetermined zone are formed, and, subsequently a knife etc. cuts the cutting predetermined zone 21.
Fig. 6 illustrating the 4th example shows the seal steps of the packaging laminated materials 1 and 1 by the example of device by this invention.
The thermoplastic innermost layers of two packaging laminated materials 1 and 1 (or two portions of the same folded-up packaging laminated material) counter to each other to be sealed.
The packaging laminated materials are pushed by the seal jaw 10 and the counter jaw 11.
The resistance 101 which forms a seal zone 10 by conduction heating is arranged in the seal jaw, and the seal jaw 10 has the flat operation surface 102.
The operation surface 112 which counters the packaging laminated material 1 is provided in the counter jaw 11, and the slope of a cross-sectional straight line shape is provided in the operation surface.
When the slope pushes the packaging laminated materials 1 and 1 by the seal jaw 10 and

the counter jaw 11, the seal prevention impurity which may remain in the seal zone is removed from this seal zone, and the melting/softening packaging material of a seal zone is mixed with the impurity.

Since the operation surface inclines, the pressure power of packaging laminated material inclines, and when innermost thermoplastic material is still in a solid state, a content residual substance is pushed out by the solid innermost layer from the seal zone.

In the softening/melting stage of innermost thermoplastic material, a surface oxide and a content residual substance are mixed with the softening/melting thermoplastic material, and/or are pushed out from the seal zone.

In addition, this mechanism does not limit the scope of this invention.

As shown in the right figure of Fig. 6, packaging laminated material is sealed by the pressure and heating, the seal zones 20 and 20 containing a cutting predetermined zone are formed, and, subsequently the zone is cut by the knife etc. in the cutting predetermined zone 21.

Fig. 7 illustrating the 5th example is the modification of the 1st example shown in Fig. 1.

Although the 1st example has one ridge, a counter jaw 11 has two ridges 111,111 to the operation surface 112 in this 5th example.

Since the 5th example has two ridges, the 3rd accumulation portion (not shown) is formed between the two ridges 111,111.

In this accumulation portion, the seal prevention impurity is mixed with melting/softening thermoplastic material, and the accumulation prevents such seal prevention.

By formation of this 3rd accumulation portion, seal intensity is strengthened, the removal distance of a seal prevention impurity is shortened, and a quicker seal is made possible.

Fig. 8 illustrating the 6th example is the modification of the 2nd example shown in Fig. 4.

Although the 2nd example has a singular cross-sectional chevron-shape, in this 6th example, a counter jaw 11 has two chevron-shapes to the operation surface 112. The 6th example is the same as the 2nd example in general.

Since it has two chevron-shapes, the mixed portion (not shown) of a thermoplastic material is formed between this two chevron-shape.

In this mixed portion, seal prevention impurity is mixed with melting/softening thermoplastic material, and the mixed portion prevents seal prevention.

Like the formation of the 3rd above-mentioned accumulation portion, by the formation of the mixed portion, seal intensity is strengthened, removal/move distance of a seal prevention impurity is shortened, and a quicker seal is made possible.

The following advantages are shown by the seal device and the filling machine of this invention so that clearly from the above-mentioned example.

(1) Even if the packaging material contains the thermoplastic layer polluted by impurities,

the seal performances can have the desired strength and the desired liquid tight.
(2) Even if the packaging materials are sealed under the liquid surface of any liquid food, any seal prevention residual substance can be removed from the surface of the thermoplastic layers, and/or the seal prevention residual substance can be well mixed.
(3) Even if the packaging laminated material is covered with the residual substance of the oxide and the content etc., the bad influence of such a seal prevention impurity can be reduced, and the possible optimum seal be obtained .
(4) In the seal jaw and counter jaw in the packaging system, the main function of a counter jaw is a pressure and the function of a counter jaw has been recognized that the importance of a function is low compared with the seal jaw.
However, the working efficiency and cost performance are optimized by decentralizing a function to a seal jaw and a counter jaw.
(5) Stagnant content liquid is not formed in the seal zone, and contents liquid such as juice does not adhere hygienically to the cross section of a seal zone.
(6) Since the seal jaw has a flat operation surface, the generating high frequency magnetic field is uniform and smooth in heat-healing by the high frequency induction heating with the inductor of the seal jaw.
Moreover, when heat-healing by ultrasonic heating using the horn of a seal jaw, there is no unevenness in a horn surface, uniform heating can be enabled, and the seal which does not have the worn-out crack of a heat-sealing surface, and roughness further can be obtained.

Availability on industry

The heat-sealing device by this invention and its filling machine manufacture the packaging container filled with liquid food, such as milk and a fruits drink, from a packaging material web.

What is claimed is:

1. A heat-sealing device which pushes the tube shape packaging material formed by tube shape from a packaging material web and filled up with liquid food in the tube under the liquid surface of the liquid food, by a seal jaw and a counter jaw, and heat-heals the tube in the tube transversal direction in a seal zone of the packaging material containing a cutting predetermined zone, characterized by that
the operation surface of the seal jaw facing the seal zone has a substantially flat surface, and
the heat-sealing device has a removal / mixture means on the operation surface of the counter jaw, which removes the seal prevention impurity which may remain to the seal zone ,from the seal zone, and/or mixes the seal prevention impurity with the melting/softening packaging material of the seal zone.

2. Heat-sealing device of the claim 1 in which the removal/mixture means is a slope provided in the operation surface of the counter jaw.

3. Heat-sealing device of the claim 2 in which the removal/mixture means is a slope of a cross-sectional chevron-shape provided in the operation surface of the counter jaw.

4. Heat-sealing device of the claim 1 in which the removal/mixture means is the ridge continuously or discontinuously provided in the operation surface of the counter jaw.

5. Heat-sealing device of the claim 1 in which the inductor for formation by high frequency induction heating is arranged in the seal jaw, and the packaging material comprises a metal thin layer and a thermoplastic material innermost layer.

6. Heat-sealing device of a claim 1 in which the horn for seal zone formation by ultrasonic heating is arranged to a seal jaw, and the packaging material has at least a thermoplastic material innermost layer.

7. Heat-sealing device of a claim 1 in which the resistance body for seal zone formation by heating is arranged in the seal jaw, and the packaging material has at least a thermoplastic material innermost layer.

8. A filling machine which pushes the tube shape packaging material formed into the tube shape from the packaging material web and filled up liquid food in the tube, by the seal jaw and the counter jaw, and heat-heals the tube in the tube transversal direction in a seal zone of the packaging material containing a cutting predetermined zone, and cuts the tube in the cutting predetermined zone, characterized by having the heat-sealing device of a claim 1.

Abstract

The heat-sealing device of this invention pushes a tube packaging material by the seal jaw and the counter jaw under the liquid surface of liquid food, and heat-heals the seal zone containing a cutting predetermined zone in the tube transversal direction. The tube shape packaging material is formed from the packaging material web, and is filled up with liquid food. The operation surface of the seal jaw facing to the seal zone has a substantially flat surface. The heat-sealing device has a removal/mixture means on the operation surface of a counter jaw. The removal/mixture means removes the seal prevention impurity from this seal zone and/or mixes the impurity with the melting/softening packaging material in this seal zone.

Even if the packaging laminated material is covered with an oxide, the residual substance, or impurities, the heat-sealing device reduces the bad influence of the seal prevention impurity, and heat-seals the optimum seal zone.

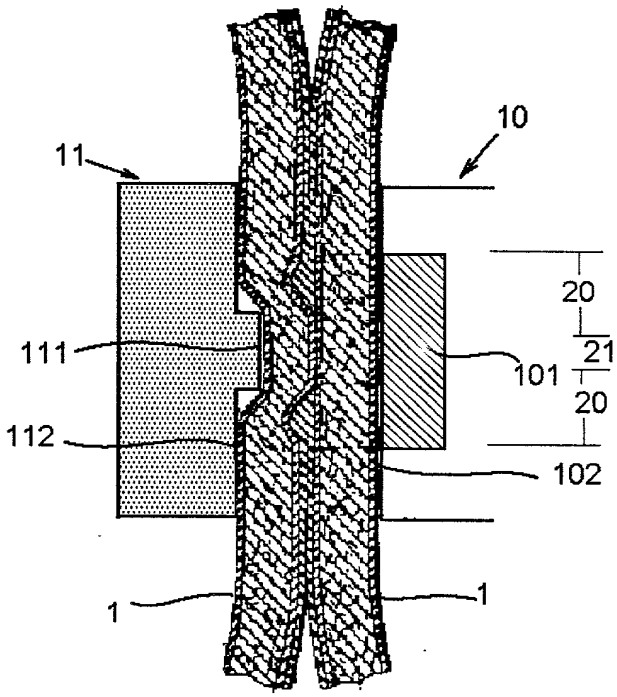

Fig. 1

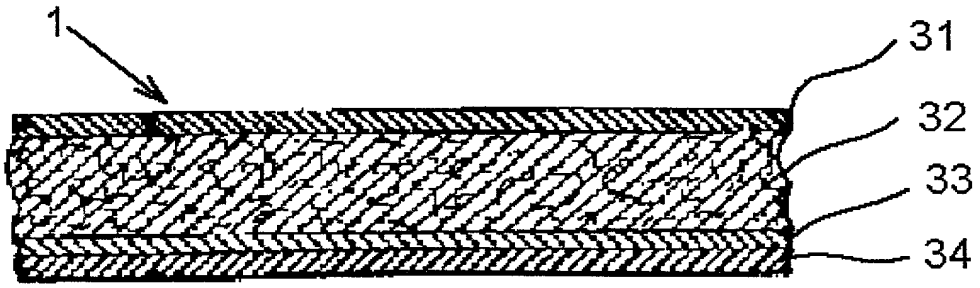

Fig. 2

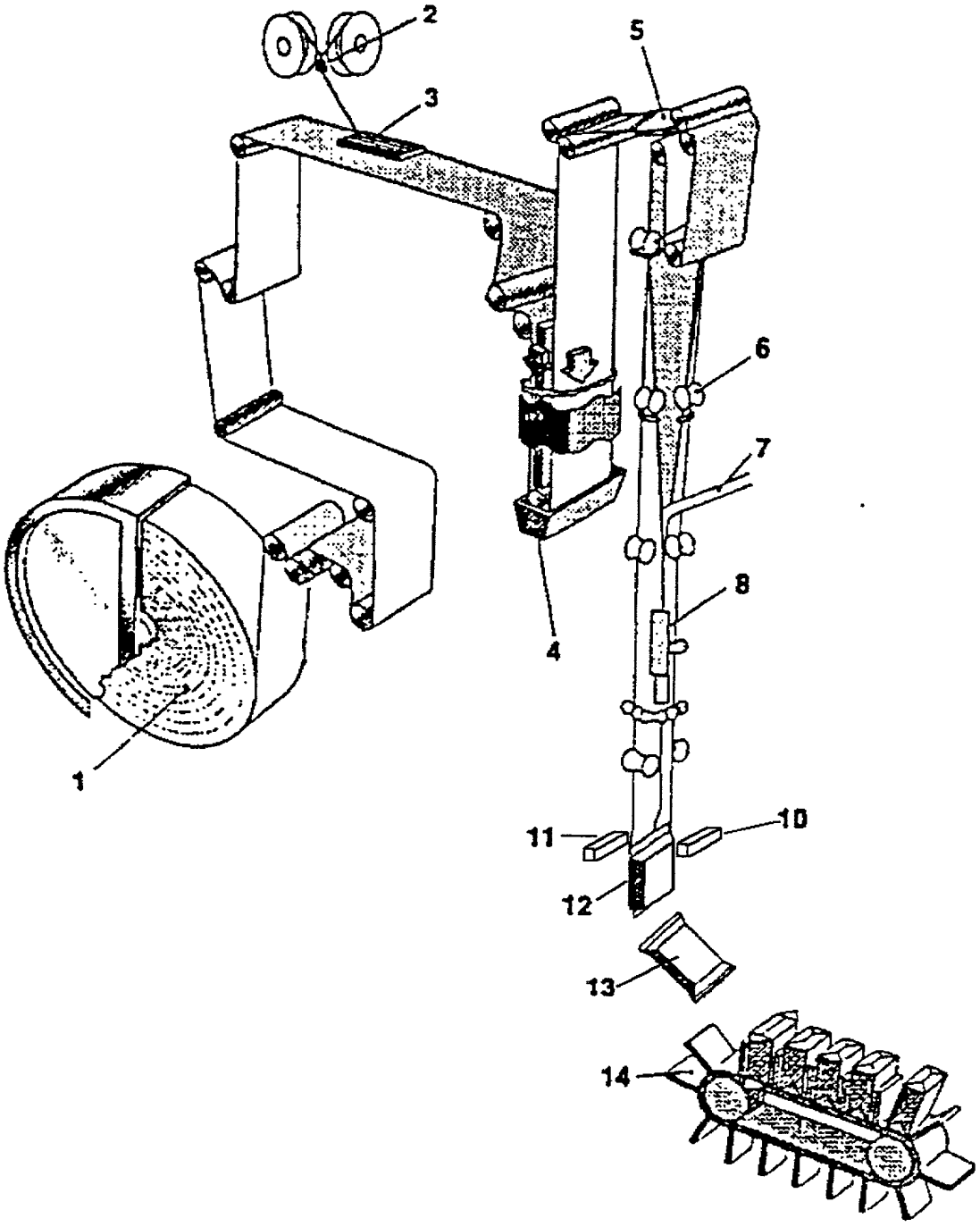

Fig. 3

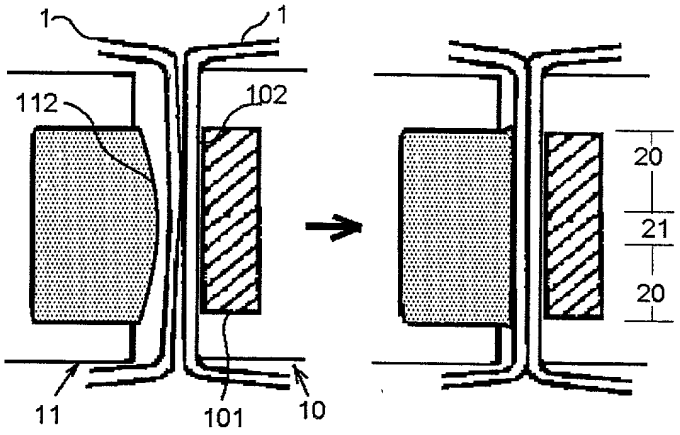

Fig. 4

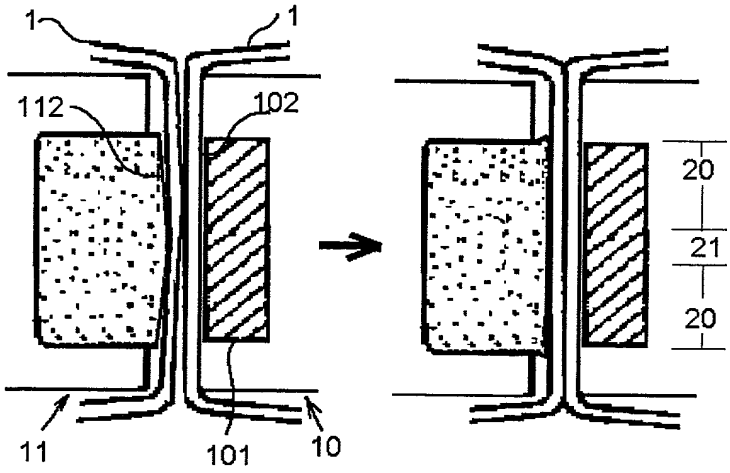

Fig. 5

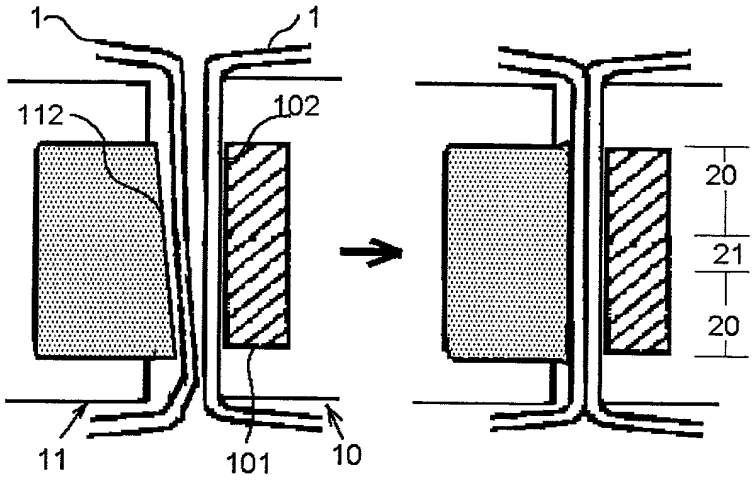

Fig. 6

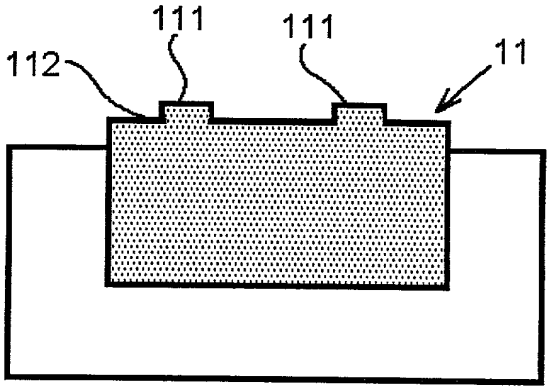

Fig. 7

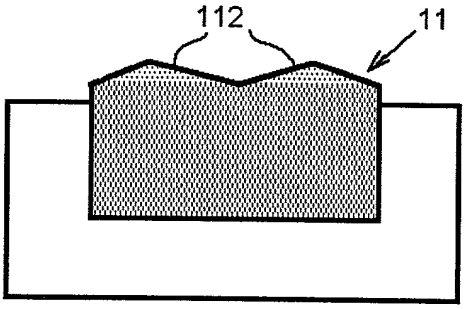

Fig. 8

COMBINED DECLARATION AND POWER OF ATTORNEY FOR UTILITY PATENT APPLICATION	Attorney's Docket No. 027650-928

As a below-named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I BELIEVE I AM THE ORIGINAL, FIRST AND SOLE INVENTOR (if only one name is listed below) OR AN ORIGINAL, FIRST AND JOINT INVENTOR (if more than one name is listed below) OF THE SUBJECT MATTER WHICH IS CLAIMED AND FOR WHICH A PATENT IS SOUGHT ON THE INVENTION ENTITLED:

HEAT-SEALING DEVICE

the specification of which

(check one) ☐ is attached hereto;

☒ was filed on October 28, 1999 as

International Application No. PCT/JP99/05966

and was amended on _____; (if applicable)

I HAVE REVIEWED AND UNDERSTAND THE CONTENTS OF THE ABOVE-IDENTIFIED SPECIFICATION, INCLUDING THE CLAIMS, AS AMENDED BY ANY AMENDMENT REFERRED TO ABOVE;

I ACKNOWLEDGE THE DUTY TO DISCLOSE TO THE OFFICE ALL INFORMATION KNOWN TO ME TO BE MATERIAL TO PATENTABILITY AS DEFINED IN TITLE 37, CODE OF FEDERAL REGULATIONS, Sec. 1.56 (as amended effective March 16, 1992);

I do not know and do not believe the said invention was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof or more than one year prior to said application; that said invention was not in public use or on sale in the United States of America more than one year prior to said application; that said invention has not been patented or made the subject of an inventor's certificate issued before the date of said application in any country foreign to the United States of America on any application filed by me or my legal representatives or assigns more than twelve months prior to said application;

I hereby claim foreign priority benefits under Title 35, United States Code Sec. 119 and/or Sec. 365 of any foreign application(s) for patent or inventor's certificate as indicated below and have also identified below any foreign application for patent or inventor's certificate on this invention having a filing date before that of the application(s) on which priority is claimed:

COMBINED DECLARATION AND POWER OF ATTORNEY	Attorney's Docket No. 027650-928

COUNTRY/INTERNATIONAL	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED
Japan	10-310092	30 October 1998	YES X NO__
			YES__ NO__

I hereby appoint the following attorneys and agent(s) to prosecute said application and to transact all business in the Patent and Trademark Office connected therewith and to file, prosecute and to transact all business in connection with international applications directed to said invention:

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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